

2021
Ion Beam Cross Section Polisher:
CP-8000+

Presented by Amy Kim

COXEM



01

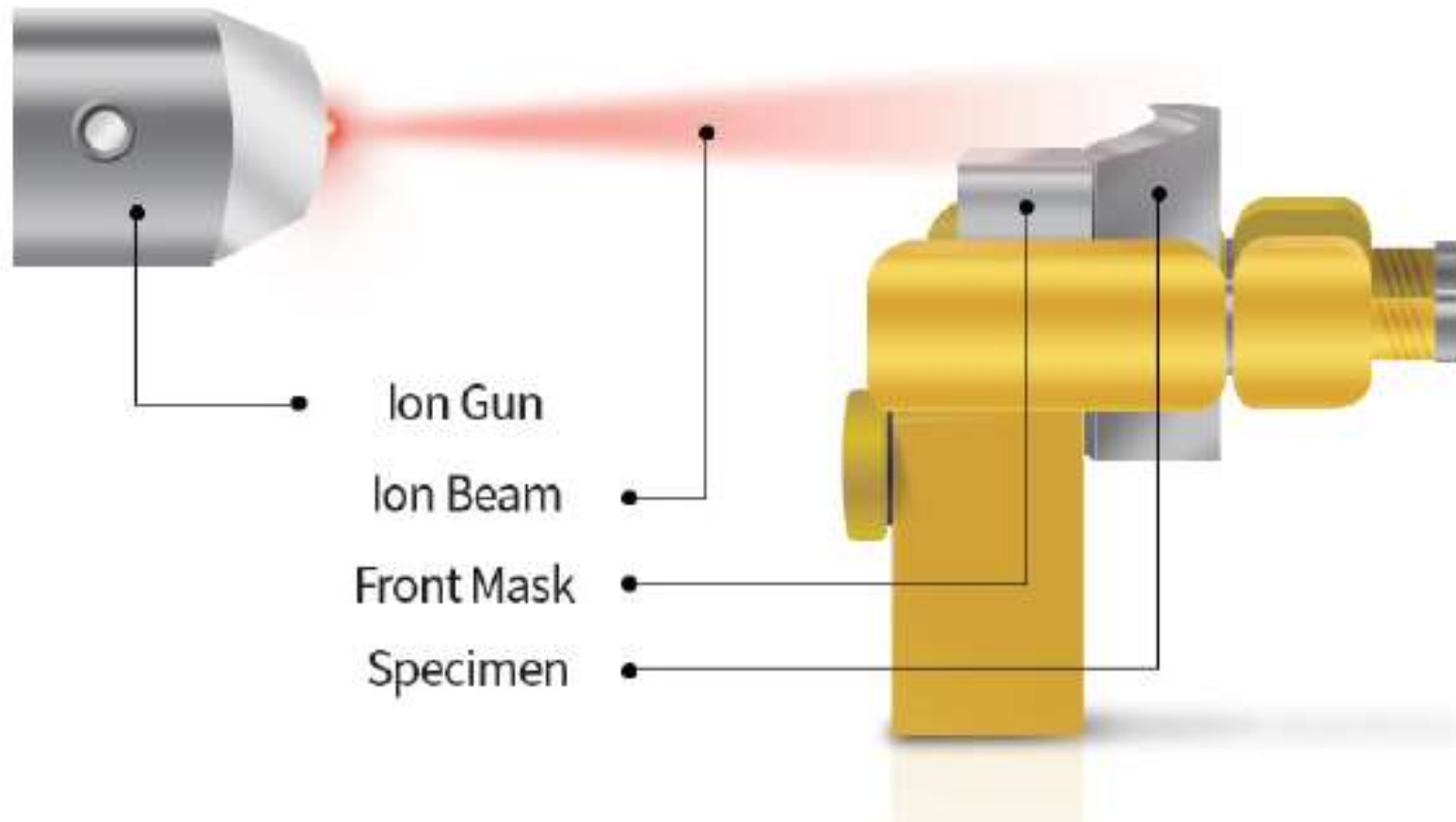
What is CP?

- Principles of CP
- Mechanical Polishing VS CP milling
- FIB milling VS CP milling

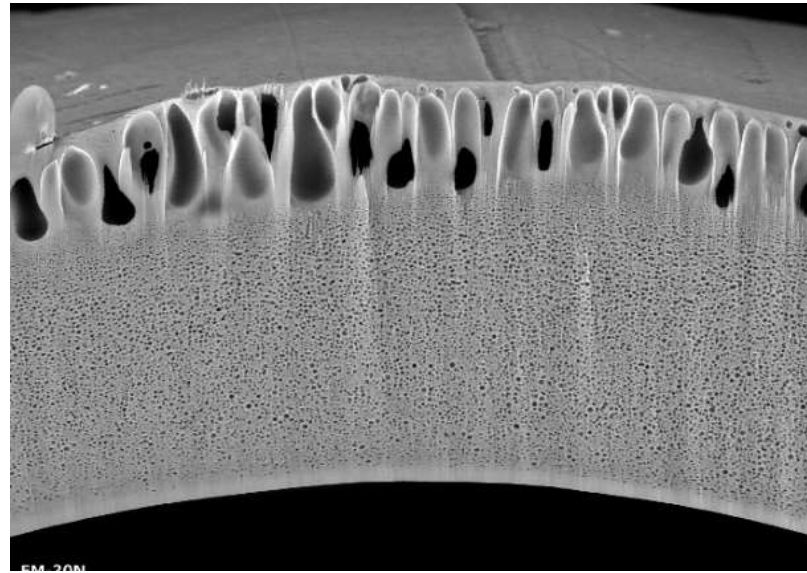
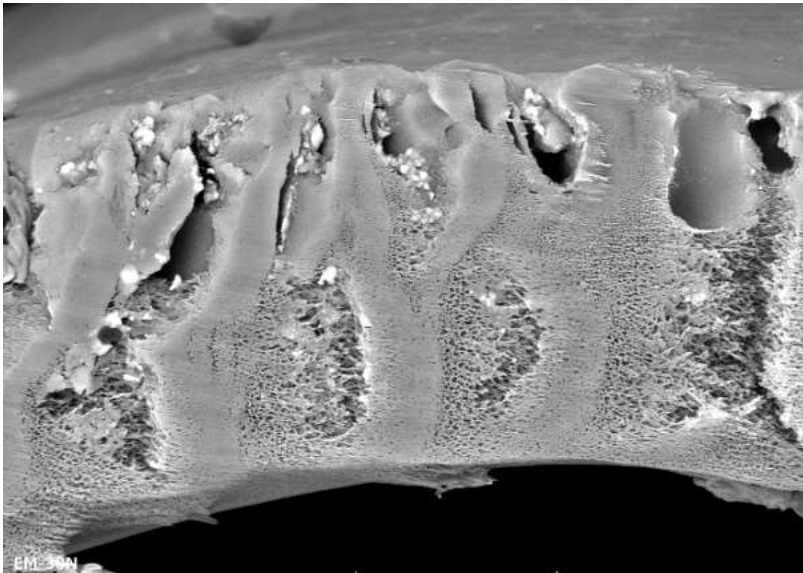
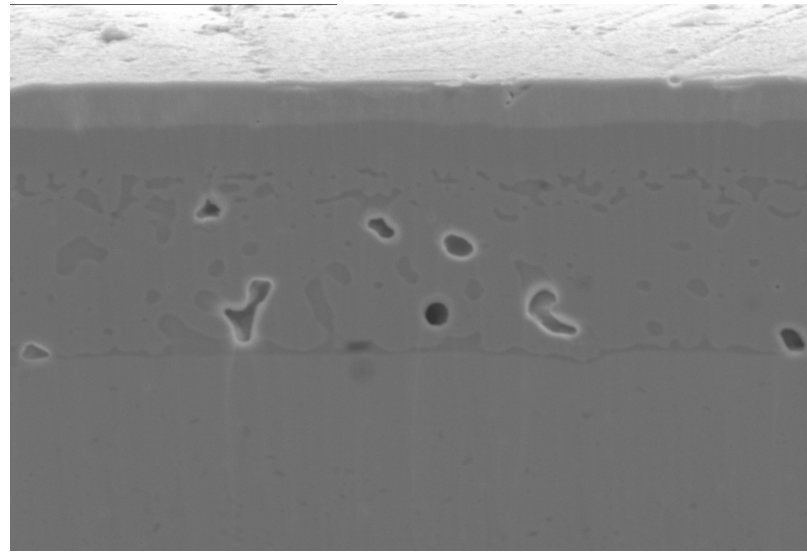
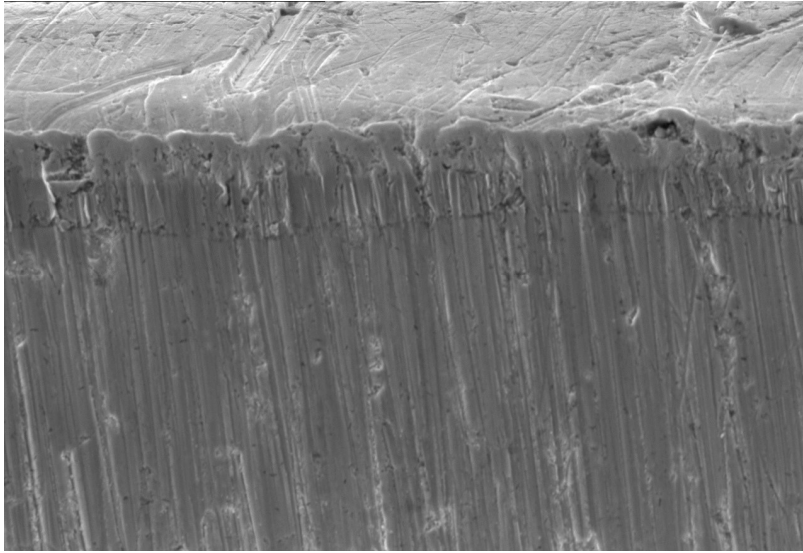
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Principles of CP

CP-8000 is a cross section polisher that prepares a sample by etching its cross-section using Ar plasma.



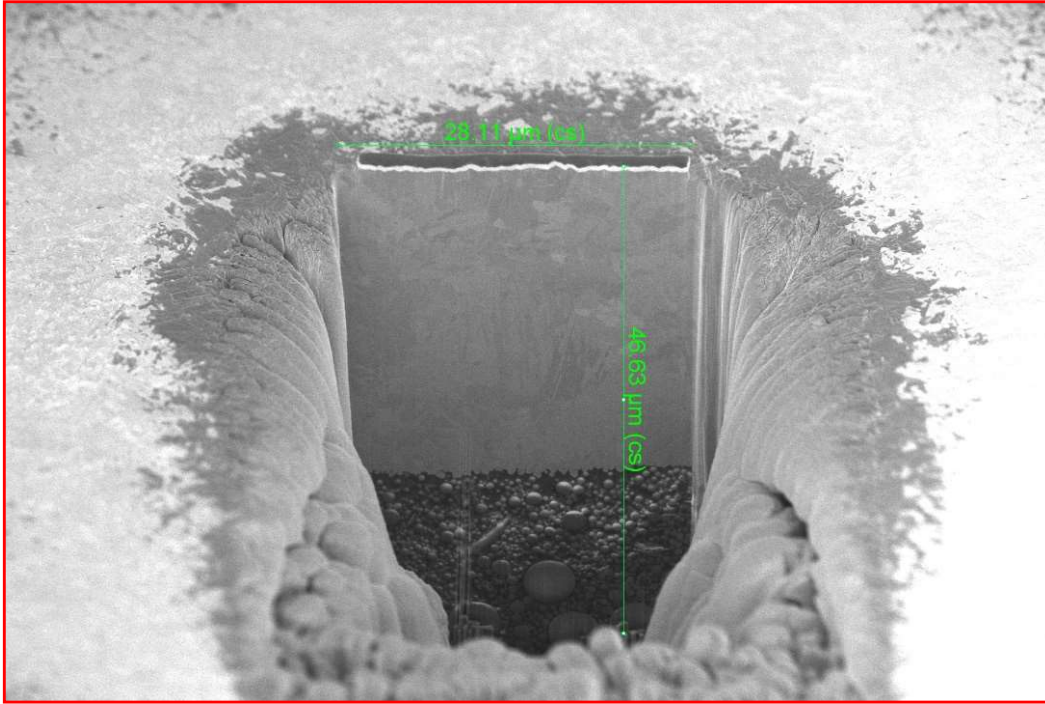
Mechanical Polishing VS CP Milling



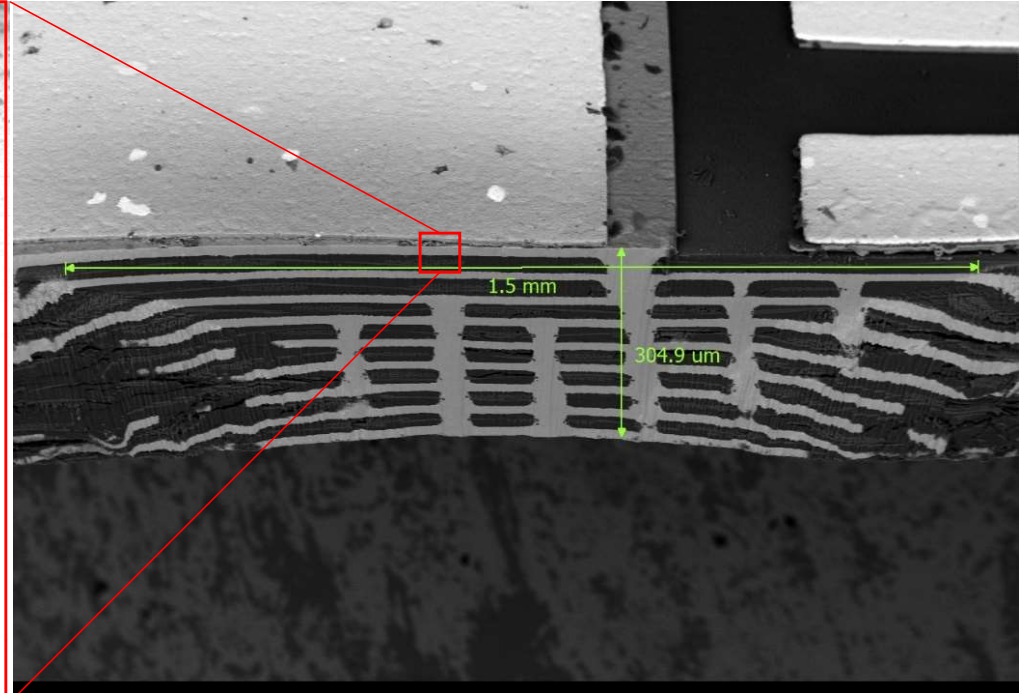
Mechanical Polishing

Ion Beam Milling

FIB Milling VS CP Milling



FIB Milling



CP Milling

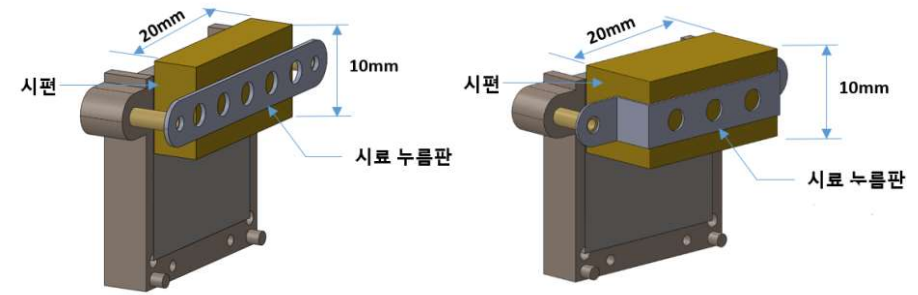
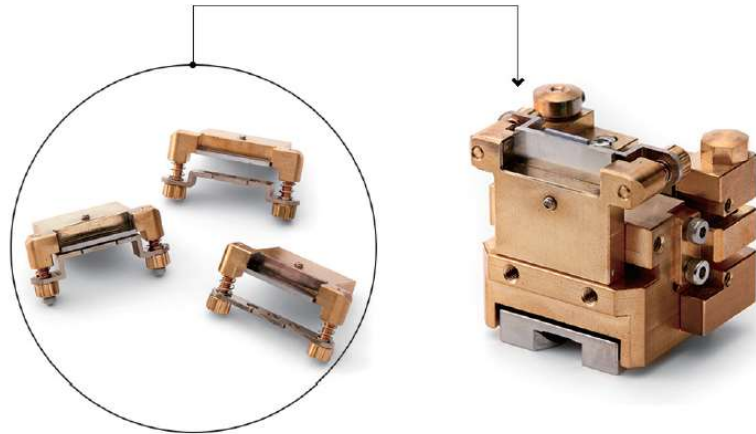


02

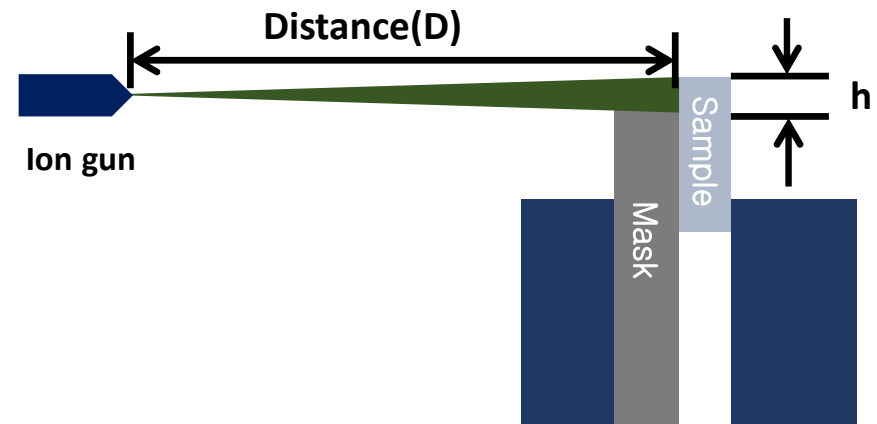
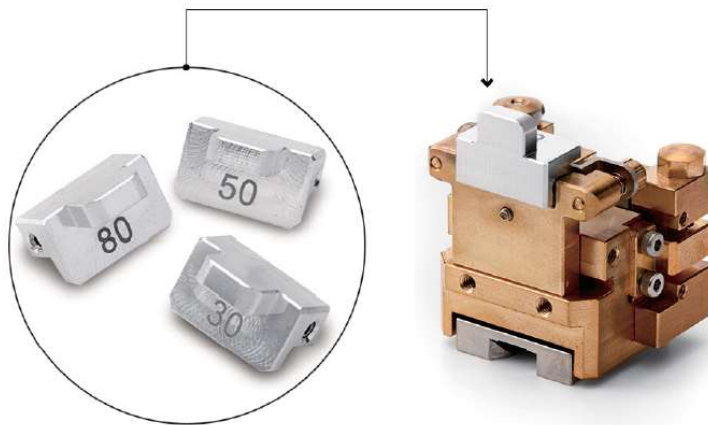
How to operate CP?

- CP process
- Software and functions

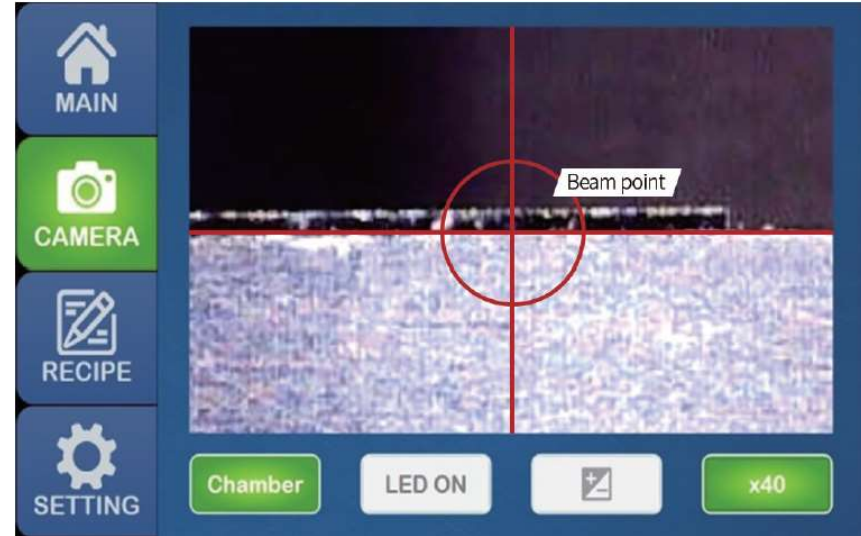
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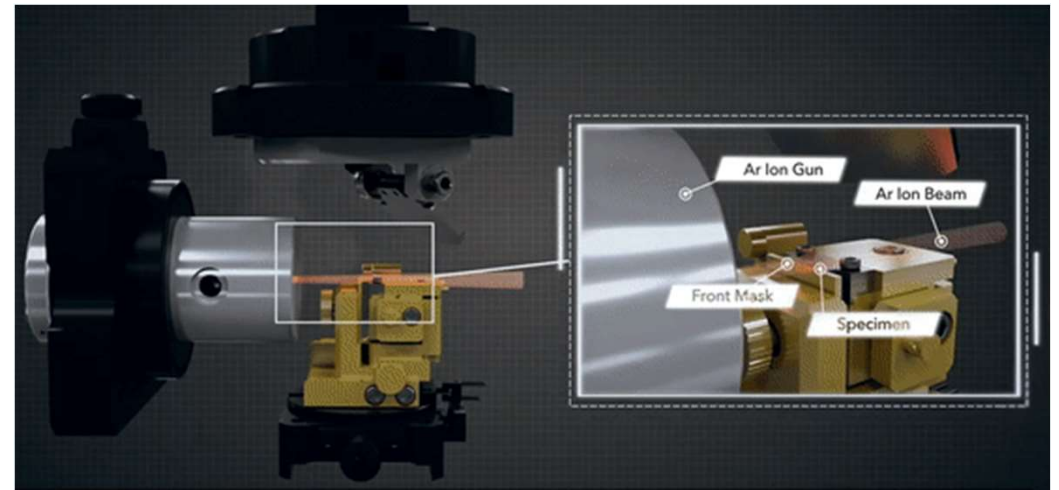
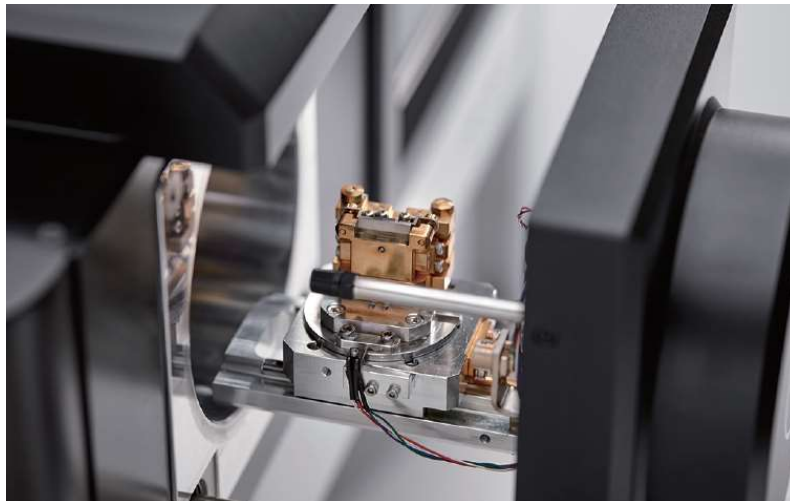
1. Select the right size of holder head and set the sample



2. Adjust the sample height, using sample height guide, (30, 50, 80 um height guides are provided)



3. Fix the sample holder onto the digital microscope & place the etching position in the center of crosshairs (Beam point)



4. Open the chamber door & load. And hit the start button after applying setting values.



Main

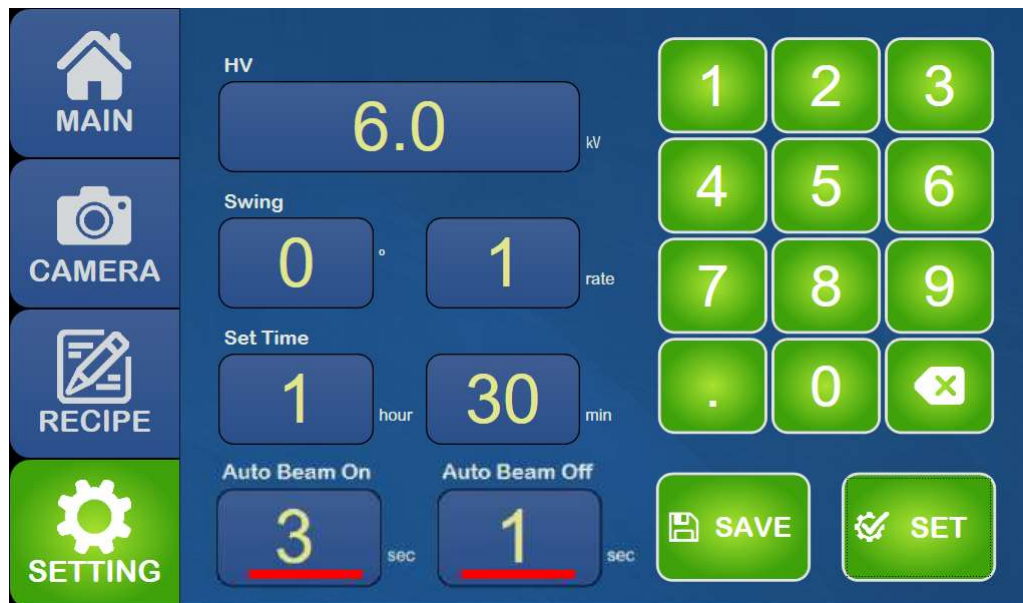
1. Camera

: Digital Microscope /
Chamber Camera

2. Auto Beam On/Off

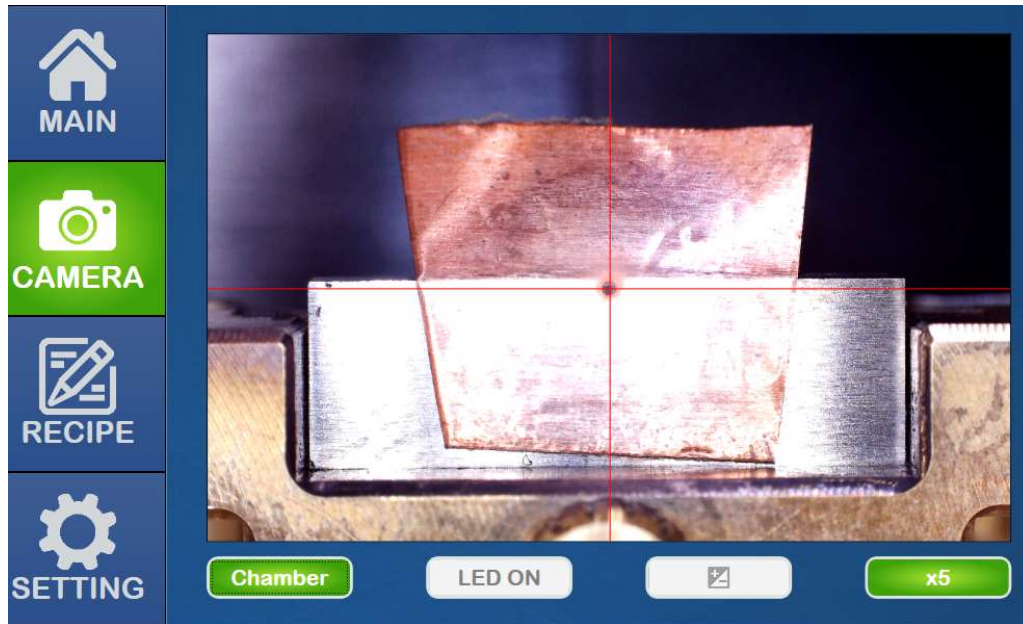
3. Step-by-step Mode

4. Flat Milling



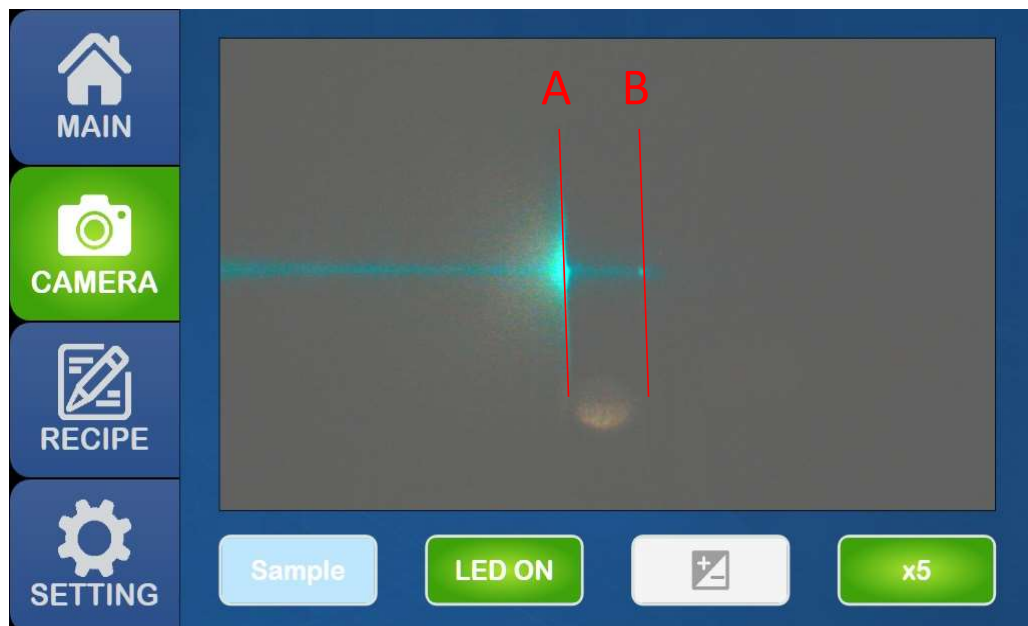
Setting

- Acc. Voltage (2~8kV)
- Sample swing degree
- Set time
- **Auto Beam On / Off time intervals set (sec)**
- Recipe Save



Digital Microscope (Sample Cam)

- Align “front mask – sample - beam point”
- Brightness adjustable
- Zoom (x5, x10, x20, x40)



Chamber Camera

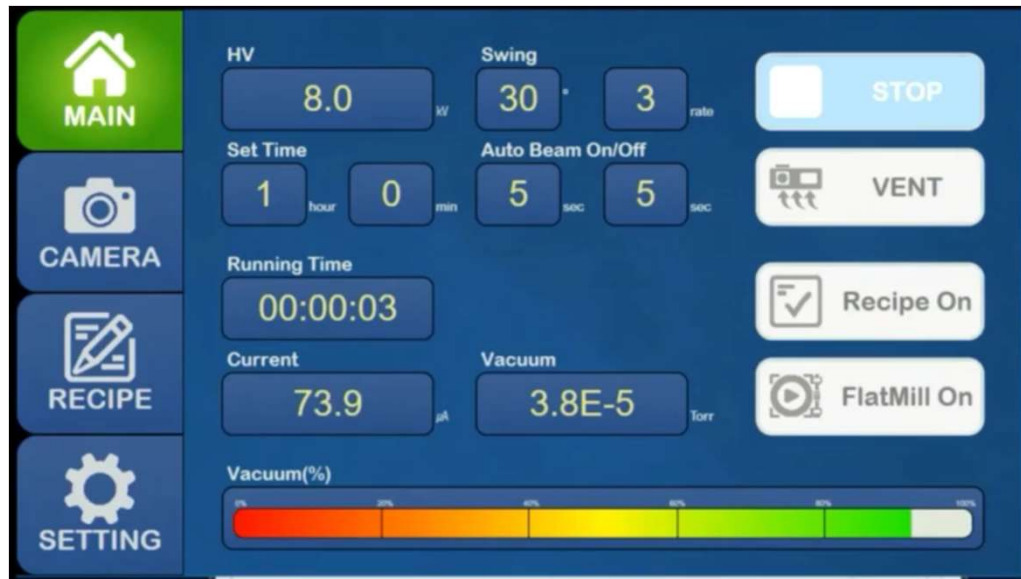
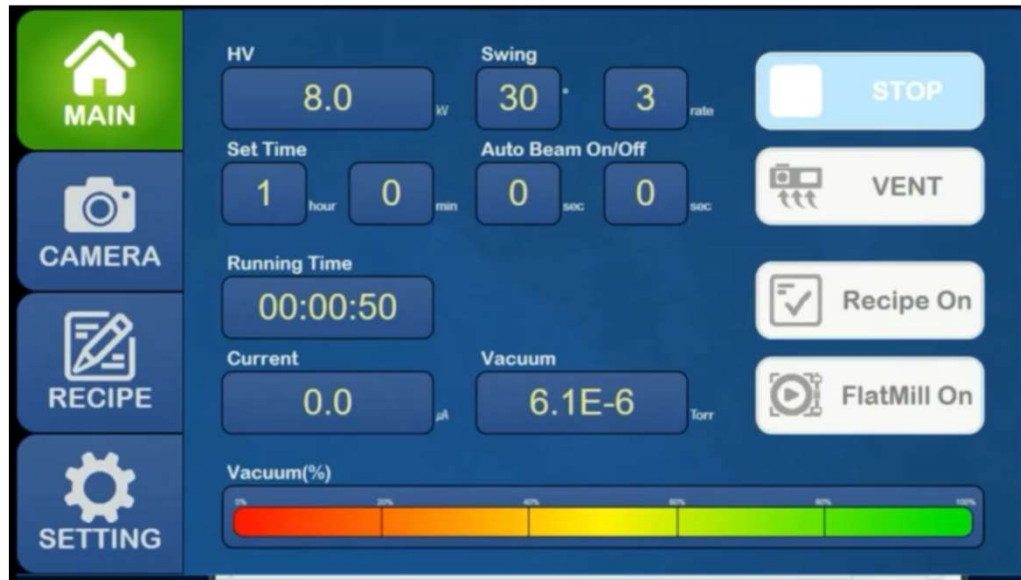
- In-chamber camera
- Observe milling state in real time
- Brightness adjustable (4 steps)
- Zoom (x5, x10, x20, x40)
- Ion beam observation mode (LED Off)

Setting – Start – Ar gas injection – Ion beam On – Etching

The screenshot displays the main control interface of the CP-8000+ system. On the left, a vertical sidebar contains four menu items: MAIN (highlighted in green), CAMERA, RECIPE, and SETTING. The main area shows the following parameters and controls:

- HV:** 8.0 kV
- Swing:** 30 °
- Rate:** 3
- STOP:** A light blue button with a square icon.
- Set Time:** 1 hour, 0 min, 0 sec, 0 sec
- Auto Beam On/Off:** 0 sec, 0 sec
- VENT:** A white button with a camera icon and three downward arrows.
- Running Time:** 00:00:00
- Recipe On:** A white button with a checkmark icon.
- Current:** 0.0 μ A
- Vacuum:** 6.6E-6 Torr
- FlatMill On:** A white button with a play icon.
- Vacuum(%):** A horizontal bar graph showing vacuum levels from 0% to 100%. The bar is currently filled with green, indicating 100% vacuum.

Auto Beam On/Off



Recipe

- Save & Load recipe
- Save recipes for **Step-by-step mode**

The screenshot displays the software interface with a vertical menu on the left containing icons for MAIN (house), CAMERA (camera), RECIPE (notepad and pencil), and SETTING (gear). The RECIPE menu item is highlighted in green. The main area shows a table with four recipes. Red arrows point from the RECIPE menu to the table. At the bottom, there are four green buttons: an up arrow, a down arrow, 'Apply', and 'Delete'.

No.	HV	Swing	Set Time	Auto Beam
1	6.0 kV	0 ° 1 rate	1 hour 30 min	0 sec 0 sec
2	6.5 kV	20 ° 2 rate	2 hour 0 min	0 sec 0 sec
3	8.0 kV	35 ° 4 rate	1 hour 0 min	0 sec 0 sec
4	3.0 kV	35 ° 4 rate	0 hour 30 min	0 sec 0 sec



03

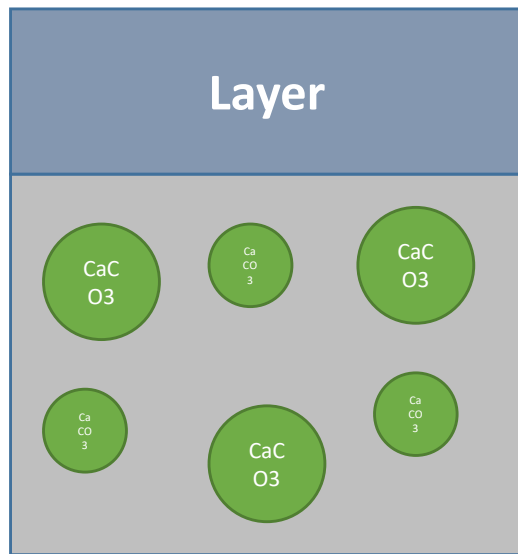
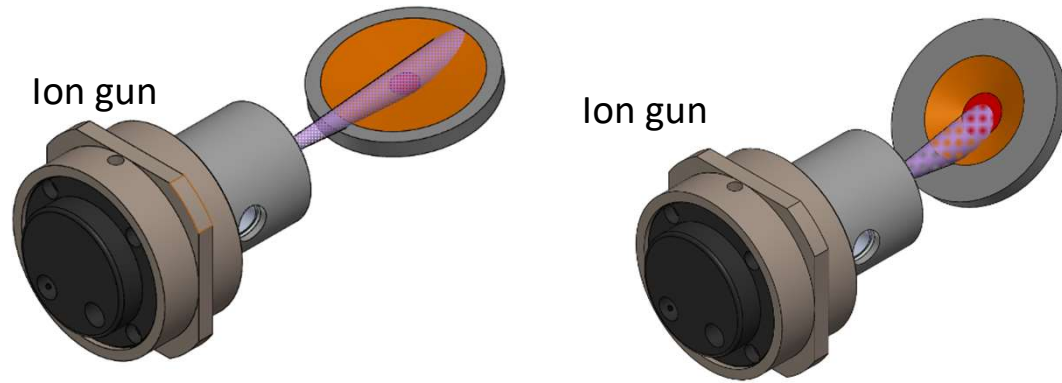
Flat Milling

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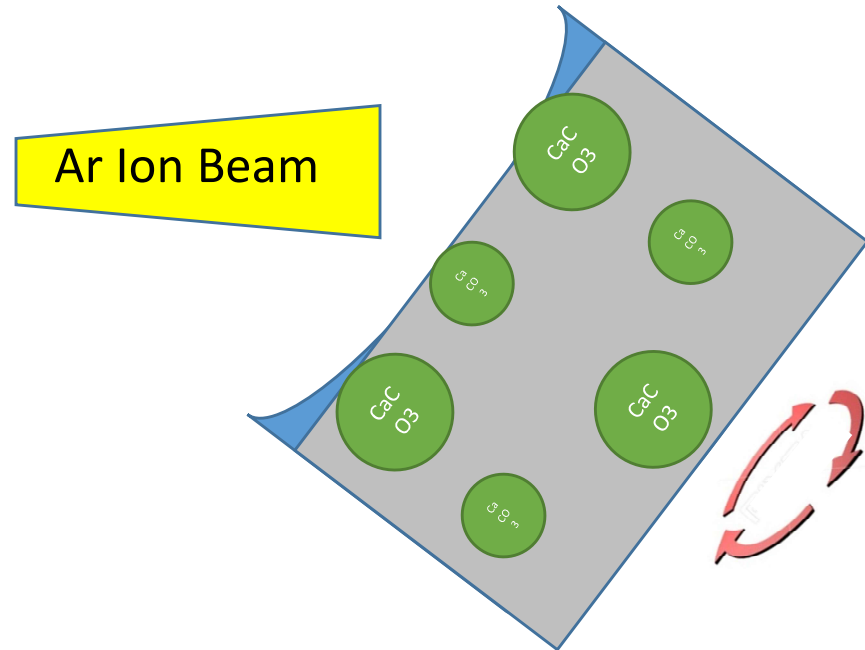
Flat Milling



Flat Milling Sample Holder



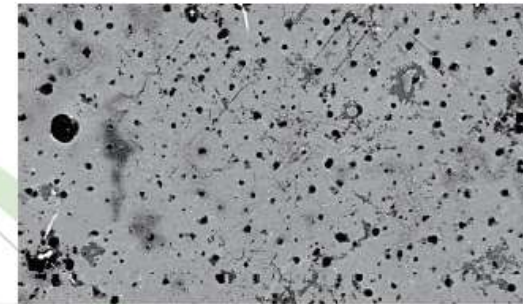
Flat-milling



Flat Milling



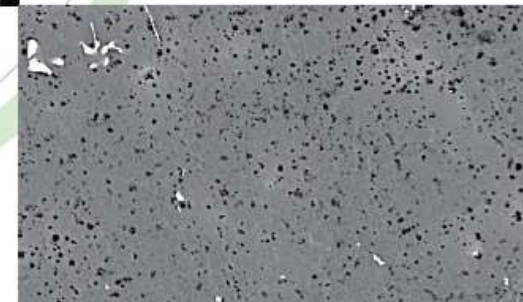
Before Milling



After 10mins



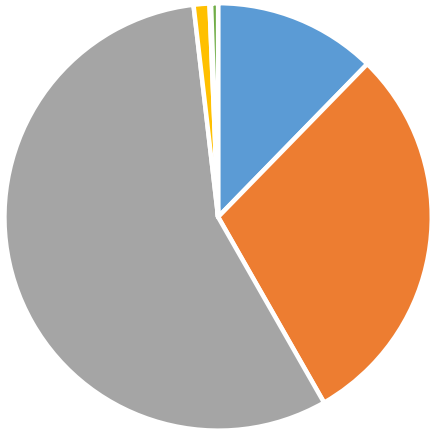
After 30mins



After 20mins

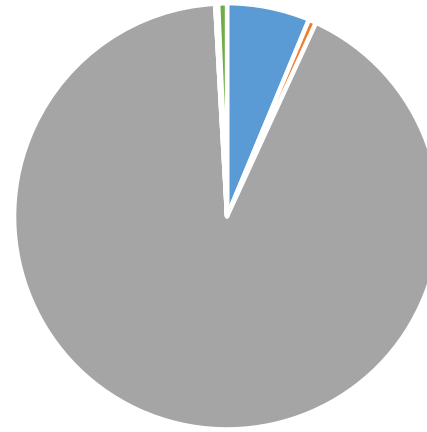
Flat Milling

Before Milling



■ C ■ O ■ Mg ■ Al ■ Mn ■ Zn

After Flatmilling



■ C ■ O ■ Mg ■ Al ■ Mn ■ Zn



Before

After Flat milling

Element	Weight (%)	
	Before	After Flat milling
C	12.31	6.27
O	29.44	0.59
Mg	56.42	92.25
Al	1.20	-
Mn	0.10	0.21
Zn	0.54	0.68
Total	100.00	100.00





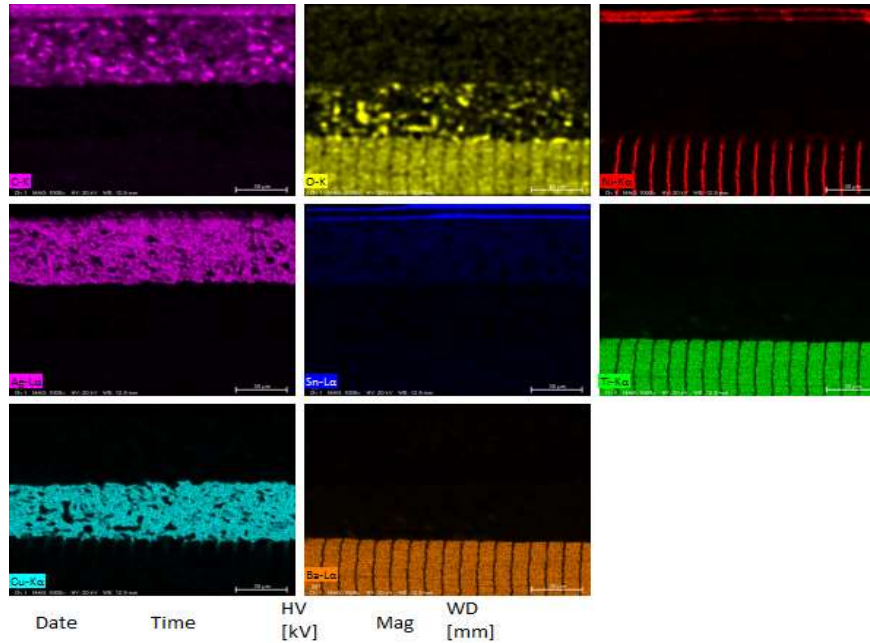
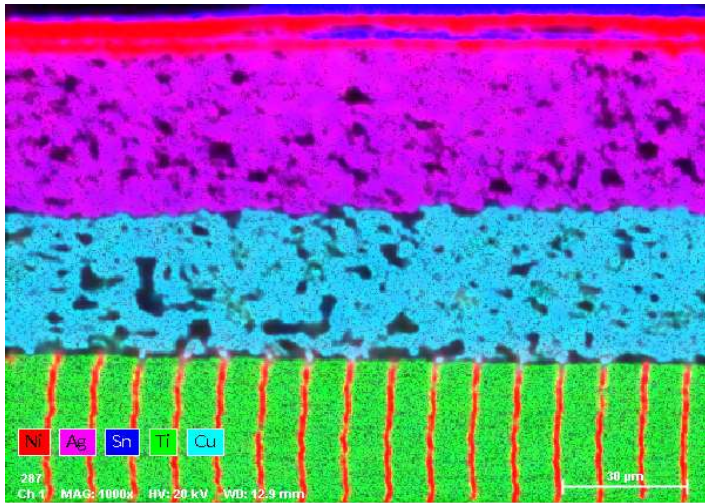
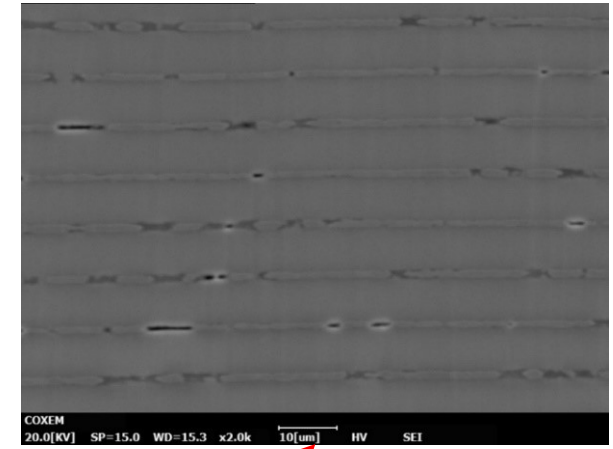
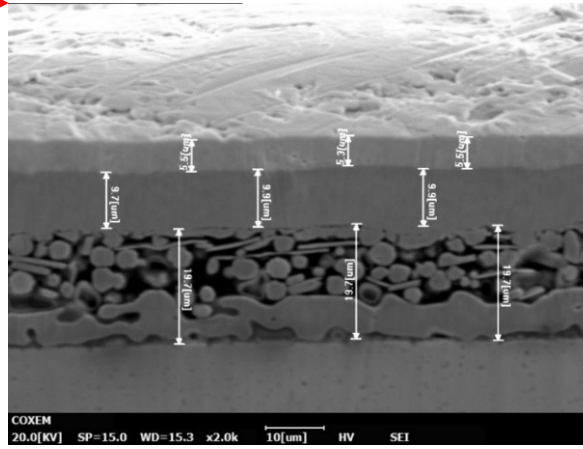
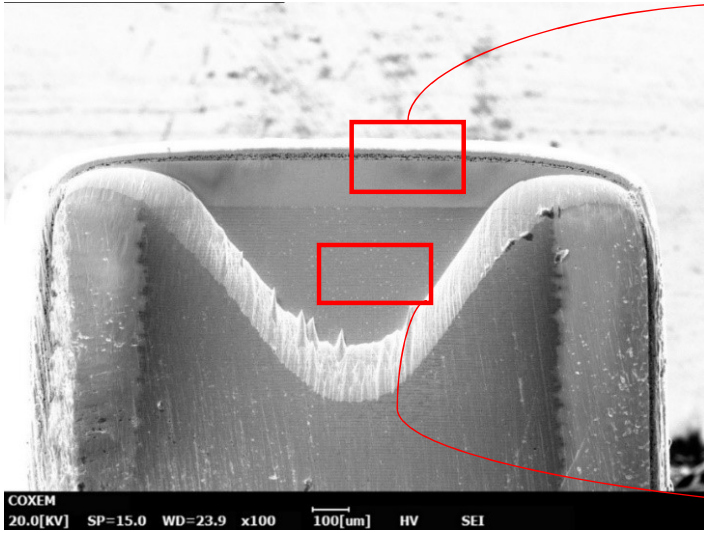
04

Application

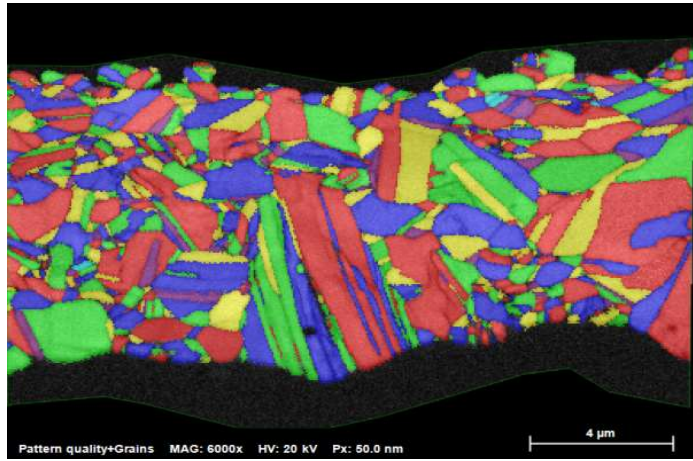
- EDS
- EBSD
- EPMA
- More images

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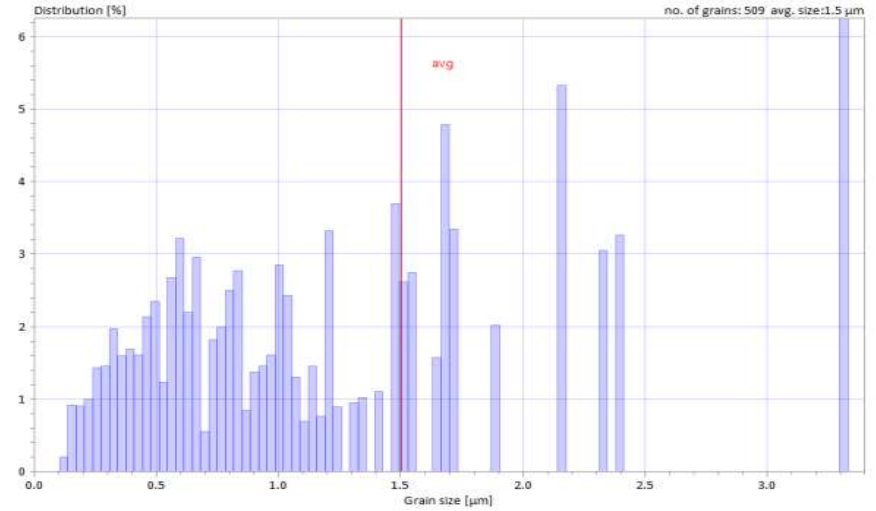
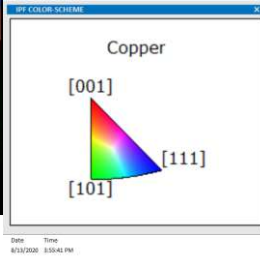
MLCC (Multi layer ceramic capacitor)



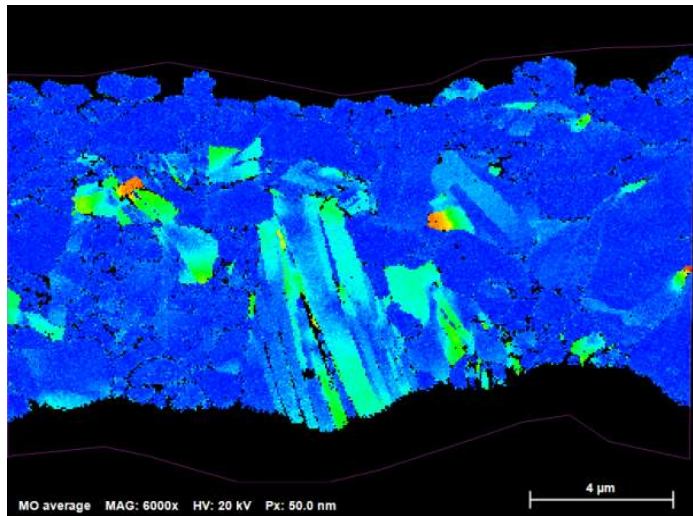
EBSD – Crystallography of metallic material



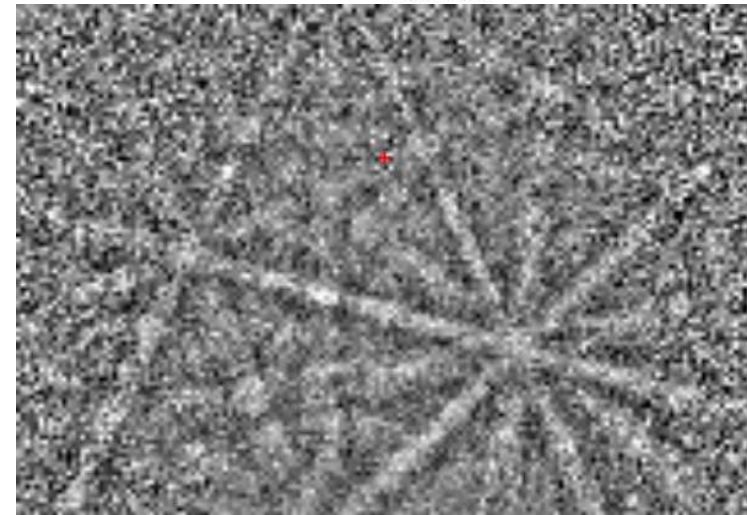
(A)



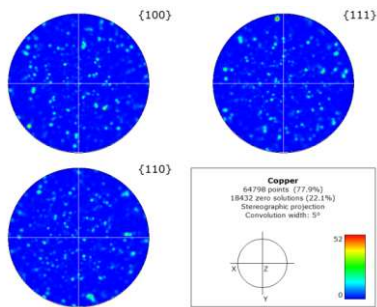
(B)



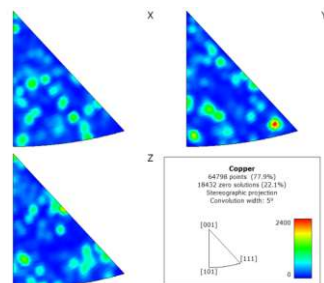
(C)



(F)



(D)

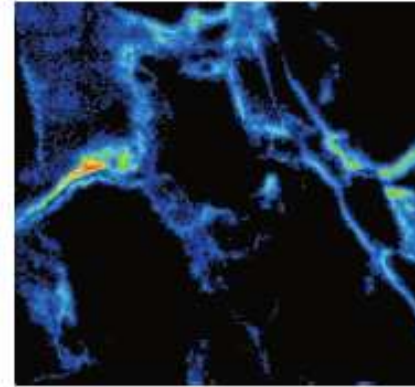
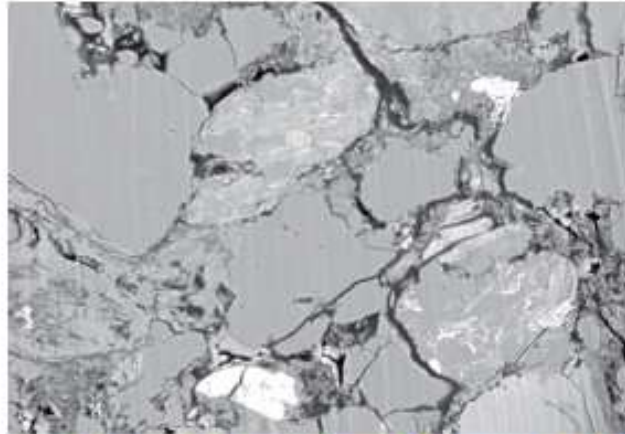


(E)

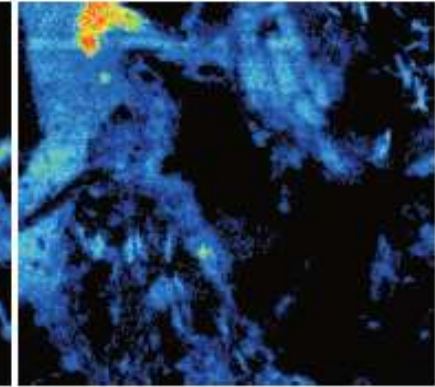
- (A) IPF map
- (B) Grain size distribution
- (C) Miss orientation map
- (D) Point group distribution
- (E) Inverse pole figure
- (F) Kikuchi pattern of Copper

Minerals

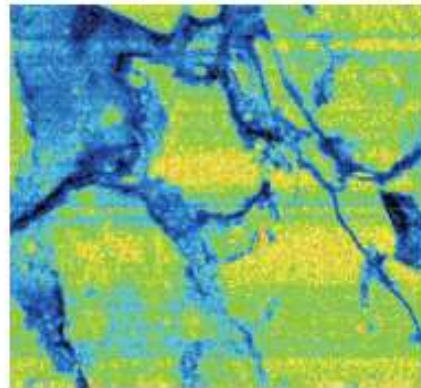
»



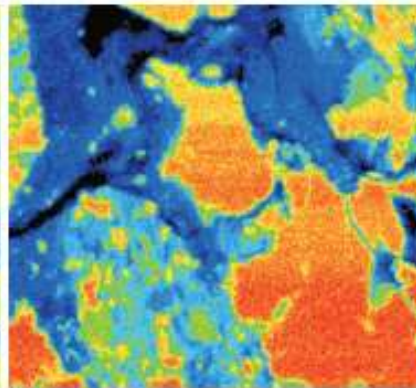
C



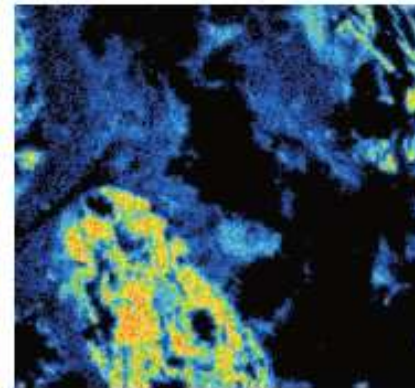
Fe



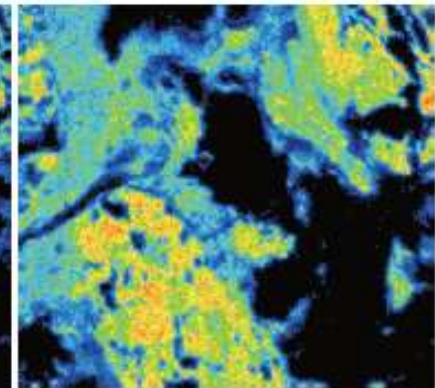
O



Si



K



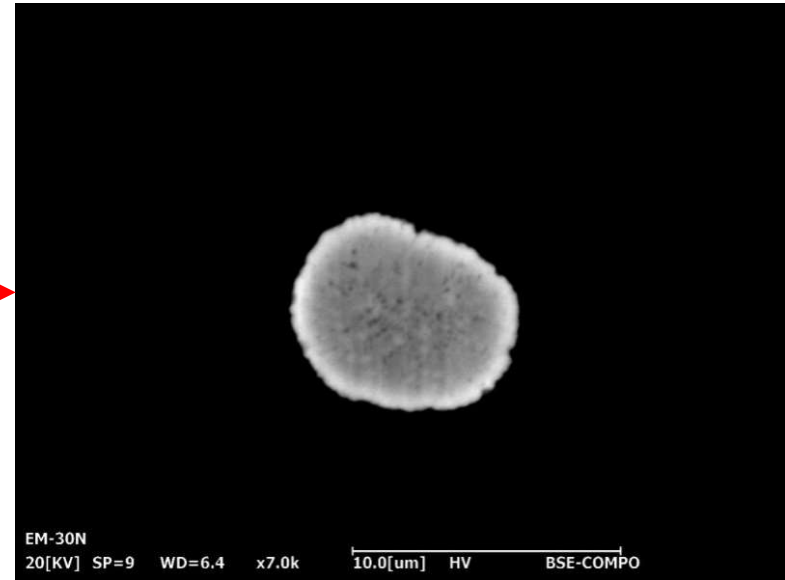
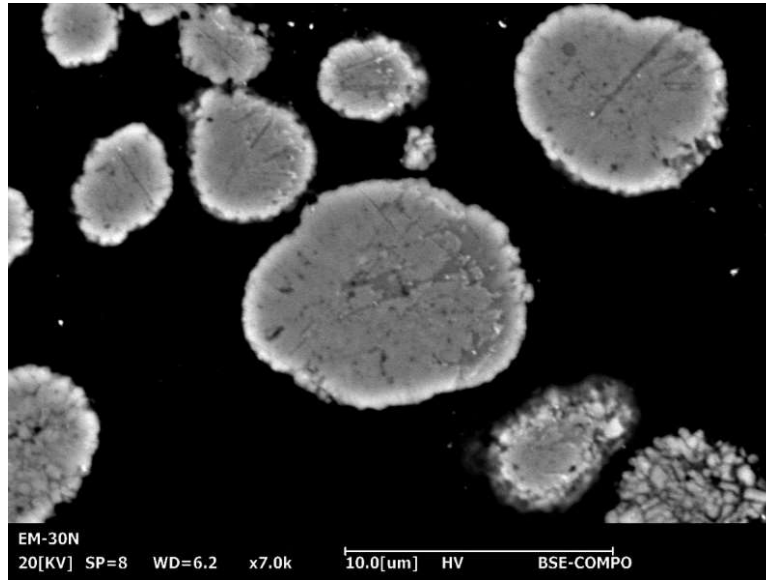
Al

ZAF Metal			
Element	Mass(%)	Atom(%)	K(%)
C	42.753	55.3457	6.980
O	32.047	31.1406	5.340
Na	0.143	0.0967	0.055
Mg	1.127	0.7208	0.594
Al	3.254	1.8752	1.968
Si	18.012	9.9698	11.842
P	0.061	0.0309	0.034
S	0.054	0.0261	0.034
Cl	0.079	0.0346	0.052
K	0.451	0.1794	0.327
Ca	0.165	0.0637	0.124
Ti	0.000	0.0000	0.000
Fe	1.855	0.5164	1.324

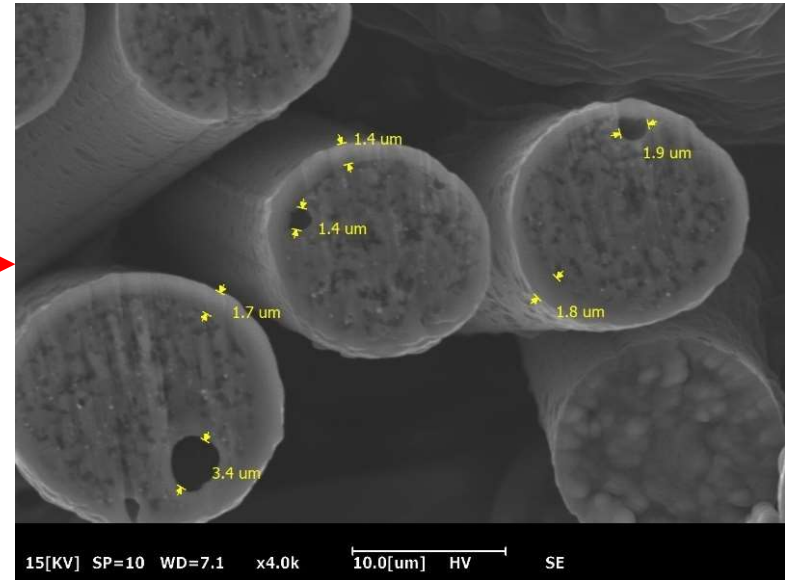
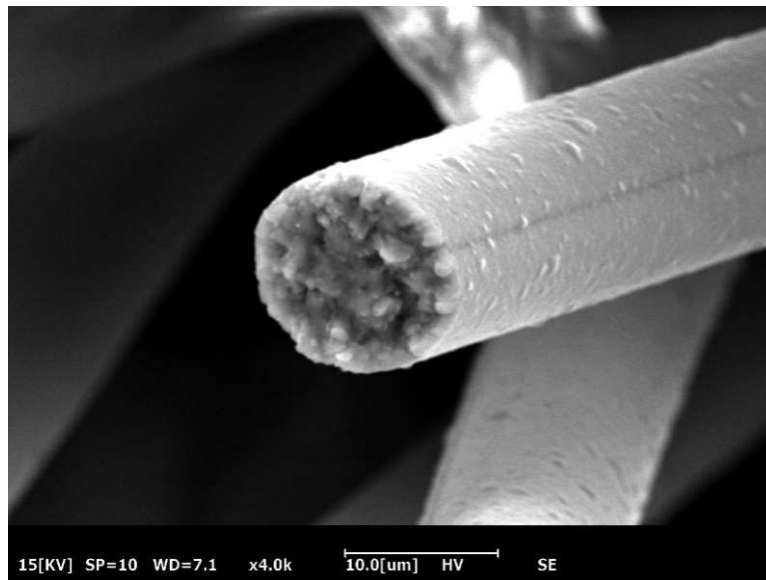
Total	100.000	100.0000	28.675
Norm.F = 1.201			

More images CP milled

Powder

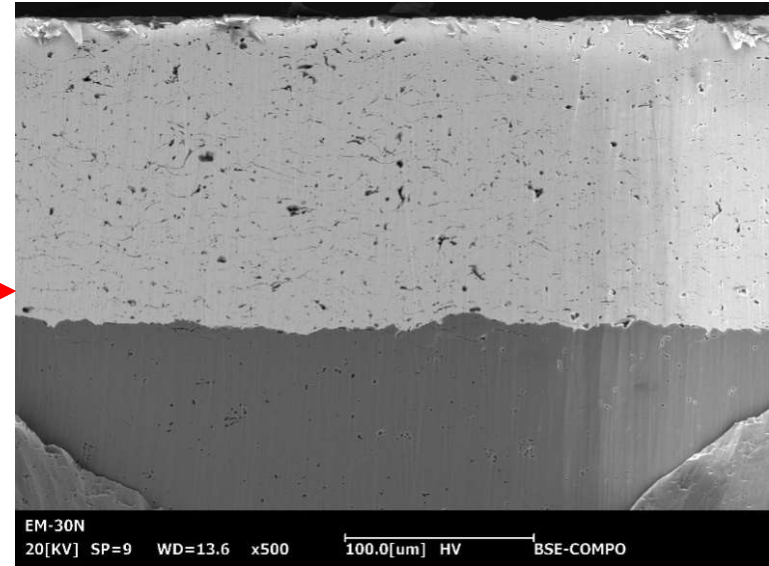
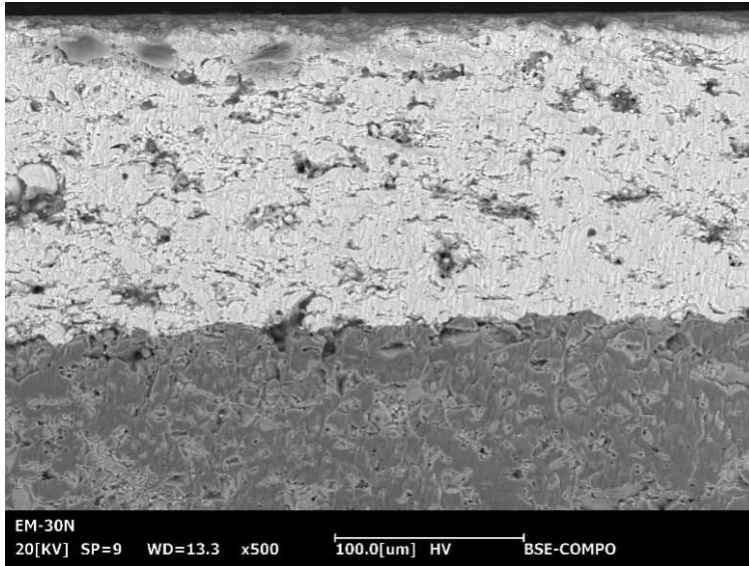


Fiber

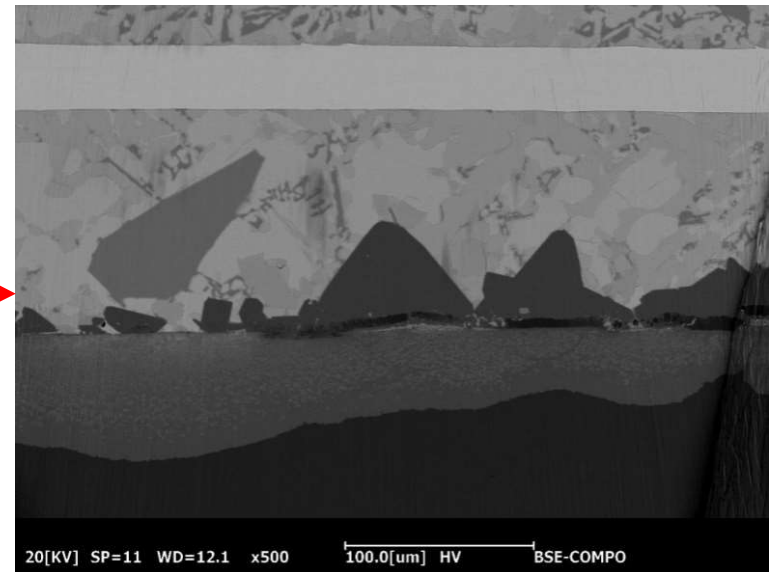
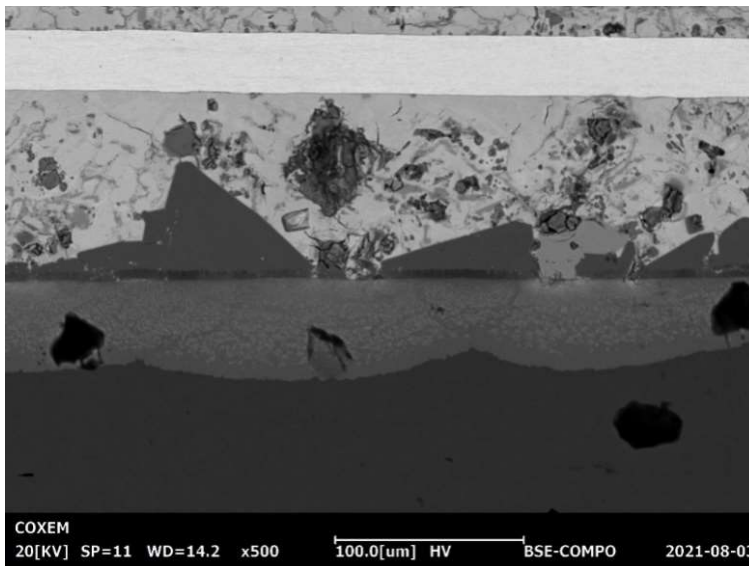


More images CP milled

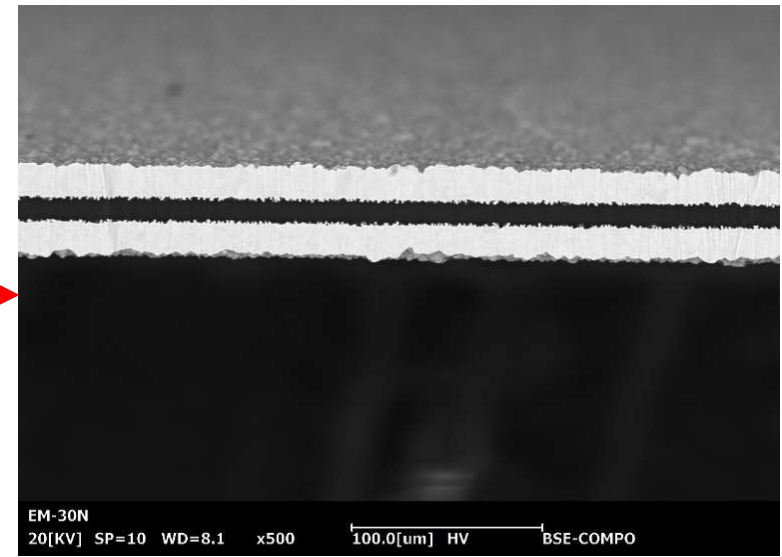
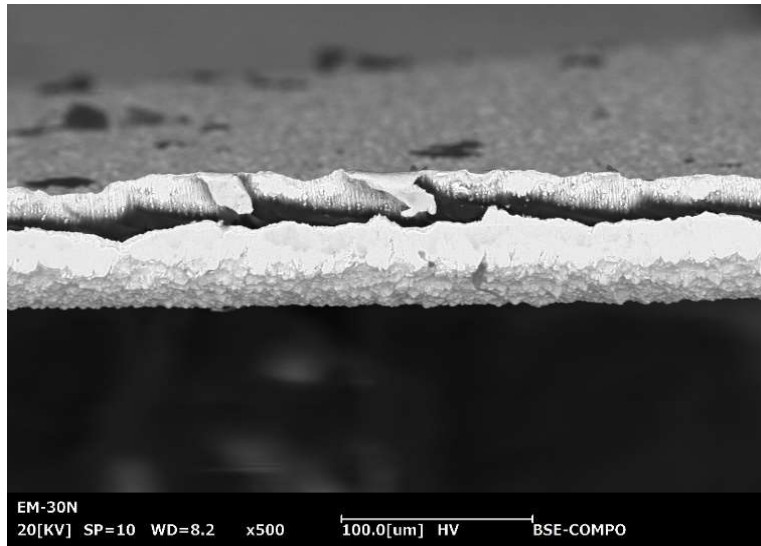
Ceramic coating



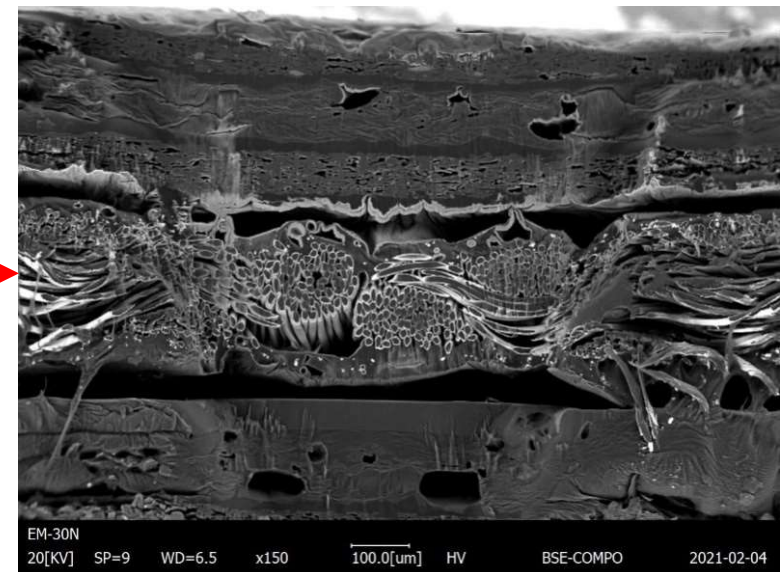
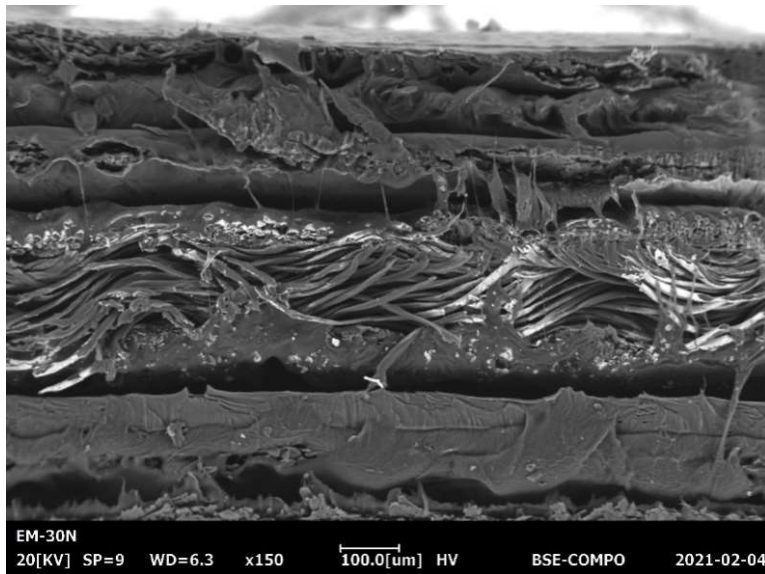
Sus Steel

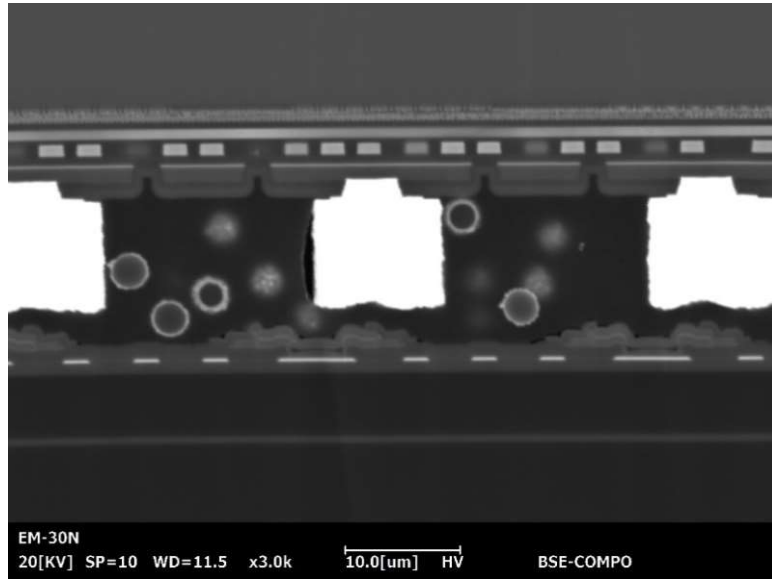


Metal Film

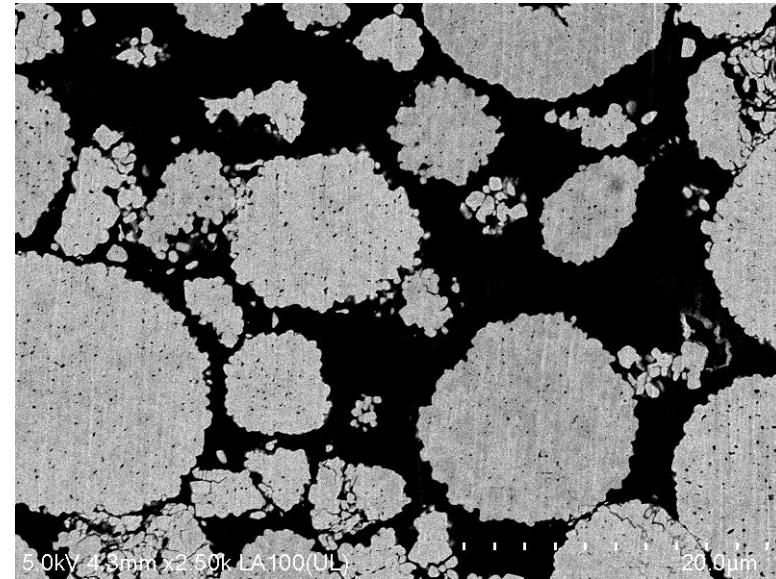


Metal Fiber

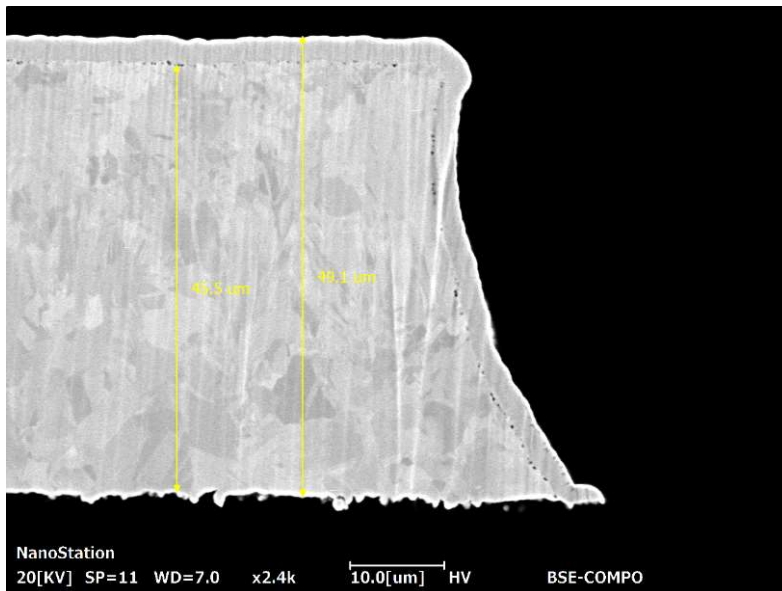




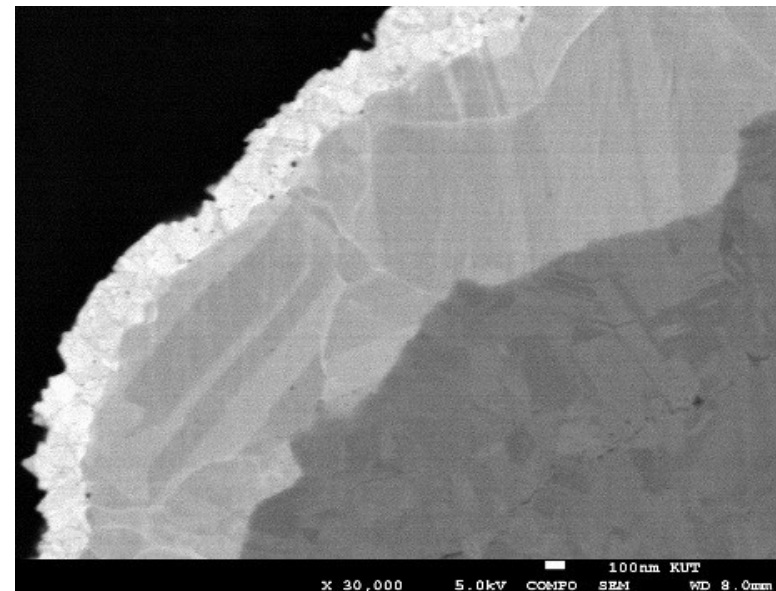
Chip on Film



Anodic Powder



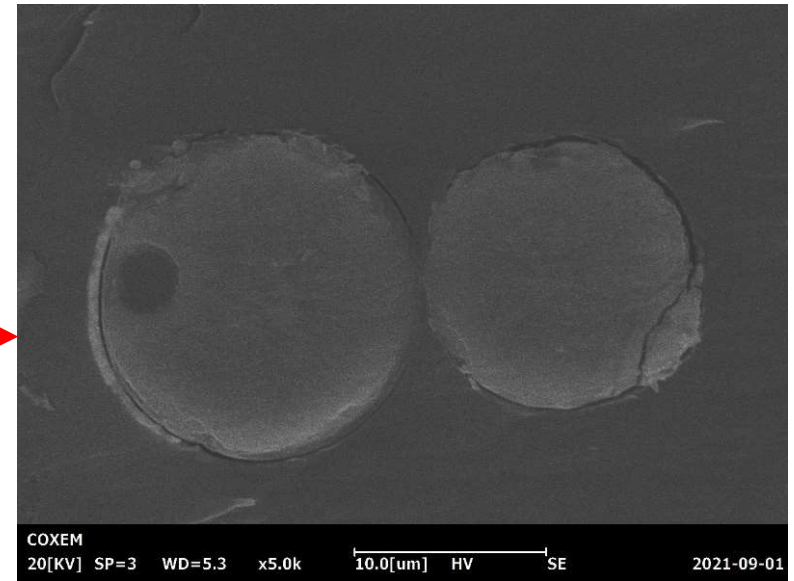
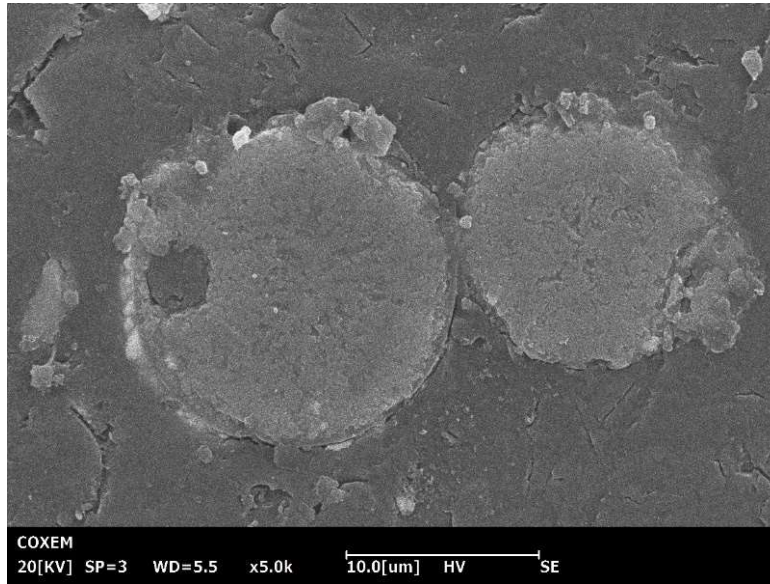
Electrode



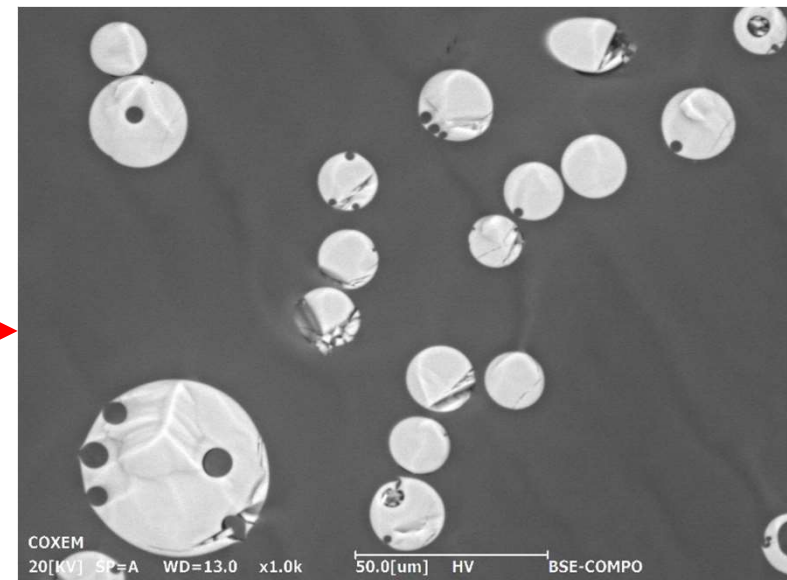
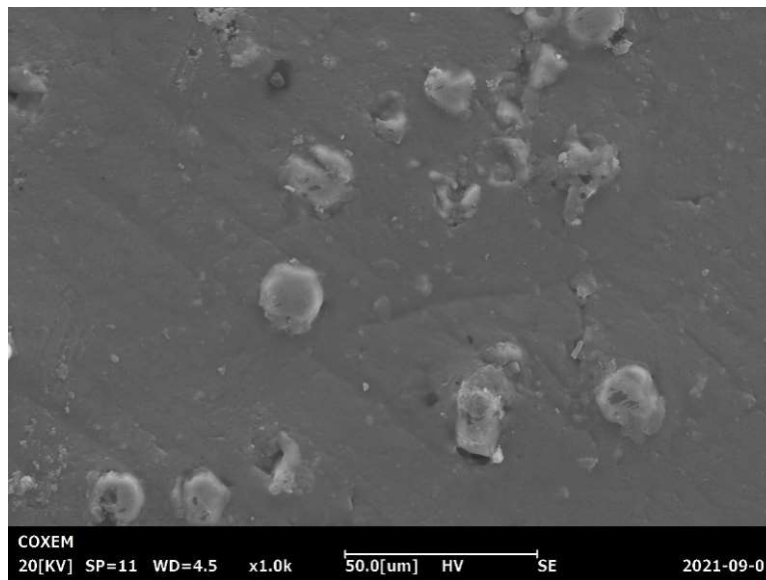
Metal coated Powder

More images CP milled (Flat Milling)

Ceramic
Fiber



Ceramic
Fiber





05

Specification

- Positioning
- Specification

COXEM

Positioning

Milling Rate

High Performance, Affordable Price



CP-8000+
(COXEM)



IM4000Plus
(Hitachi)



IB-19530CP
(Jeol)



ArBlade 5000
(Hitachi)



SEMprep2
(Technoorg Linda)



Model 1061
(Fischione)



Ilion 2
(Gatan)



EM TIC 3X
(Leica)

Price

Specification

Ion accelerating voltage	2 to 8kV
Milling speed	700 μ m/h (at 8kV on Si wafer)
Sample stage swing angle	$\pm 35^\circ$
Maximum sample size	20(W) \times 10(L) \times 5.5(T)mm 16(W) \times 10(D) \times 9.5(H)mm
Specimen movement range	X axis movement : ± 1.5 mm / Y axis movement : ± 2 mm
Flat milling stage tilt angle range	40 $^\circ$ to 80 $^\circ$
Sample size for flat milling	$\varnothing 30 \times 11.4$ (H)mm
Operation	7 inch touch panel
Digital Microscope for sample positioning	Mag. x5, x10, x20, x40
Chamber camera for monitoring	Mag. x5, x10, x20, x40 Brightness adjustable in 4 steps Ion beam observation mode (LED Off)
Gas for Ion	Argon gas (99.999%)
Gas pressure	0.1 Mpa (14.5psi)
Gas flow control	Mass Flow Control
Vacuum systems	Turbo pump, Diaphragm pump
Dimension	607(W) \times 472(D) \times 277.5(430.5)(H) mm
Weight	Main system 36kg / Diaphragm pump 6.5kg
Features	Auto Beam On/Off mode Step by step mode

Thank you

COXEM